International Journal for Modern Trends in Science and Technology, 8(12): 39-44, 2022

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0812007
Available online at: http://www.ijmtst.com/vol8issue12.html

Biodiversity of Aquatic Insect Study of Kodiveri Dam Water, Erode District, TamilNadu, India

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To Cite this Article
A Jude Jebri Raj, A Saravanan and M. Prabhu. Biodiversity of Aquatic Insect Study of Kodiveri Dam Water, Erode District, TamilNadu, India. International Journal for Modern Trends in Science and Technology 2022, 8(12), pp. 39-44. https://doi.org/10.46501/IJMTST0812007

Article Info
Received: 16 November 2022; Accepted: 27 November 2022; Published: 07 December 2022.

ABSTRACT

Aquatic insects are of great importance to water bodies and their presence in water serves various purposes. In the present investigation biodiversity of aquatic insect study of Kodiveri Dam water Erode district, Tamilnadu, India. The month-wise occurrence of individuals during the month from August to November and March to June at season I, II is shown. The maximum individuals of 604 & 383 were observed in the month of October & March and the minimum individuals of 550 & 383 were recorded in the month of August & June. The month-wise occurrence of Shannon – Wiener diversity index (H') the maximum diversity index of 1.937 & 1.924 was observed in the month of September & June and the minimum diversity index of 1.908 & 1.871 was recorded in the month of October & May. The Margalef index (d) species richness the maximum species richness of 1.268 & 1.36 was observed in the month of August & June and the minimum species richness of 1.249 & 1.345 were recorded in the month of October & March. The Simpson index (D) species richness the maximum species richness of 0.84 & 0.836 was observed in the month of August & March and the minimum species richness of 0.8304 & 0.826 were recorded in the month of October & May. The month-wise occurrence of Pielou's species evenness the maximum species evenness of 0.771 & 0.761 was observed in the month of September & March and the minimum species evenness of 0.7487 & 0.722 were recorded in the month of October & May. The statistical diversity profile, histogram, PCA and cluster analysis confirmed that the distribution, abundance and diversity of the aquatic insects are the highest insect density in the monsoon and summer seasons. The present research knowledge highlights the need of conservation of insect's faunal of the biodiversity to preserve the natural balance of the ecosystem. The number of recorded species in the present study signifies the rich diversity of aquatic insects in the only Kodiveri dam site of Erode district.

Key Words: Aquatic Insects, Bio-Diversity, Season Wise, Statically Analysis

INTRODUCTION

Aquatic insect can be found almost in every type of aquatic habitat throughout the world including lakes, torrential streams, highly saline pools, phytotelmata, coastal waters and estuaries, acid peat swamps, ground, hot springs and even pools of crude oil seeping from the ground (Abowei and Ukoroije, 2012). The warm, wet climate of the TamilNadu region is ideal for the life cycles of many aquatic insects which are usually dependent on moist habitat. The presence of a wide variety of environments, particularly in tropical rainforest, provides an enormous number of ecological niches. Unfortunately habitat destruction is causing the extinction of many aquatic insects. Some of them, especially diptera adults are of medical importance, for example mosquitoes and house flies are the major

vectors of a wide range of diseases of humans and other animals. Game fishes feed on many kinds of Diptera that live in and on the water (Ampon Payakka and Taeng-On Prommi, 2014). The extinction of aquatic insect may affect the entire population in the ecological system because they act as an important source of food for many invertebrate. Biodiversity is the quantity, variety and distribution across biological scales ranging through genetics and life forms of populations, species, communities and ecosystems (Bonada *et al*., 2005). The limited number of insect's biodiversity studies was carried out so far in the South TamilNadu. Having the above facts in mind, the objectives of this study was to compare the insect biodiversity in Kodiveri dam. This information will be valuable for monitoring the ecological development of dam sites in South TamilNadu. In the present investigation to estimate diversity of dam insects from Erode district.

Materials and Methods

Biodiversity of Insects

Collection and Sampling

In present work collection of most of the insects (species) was done twice in the year August to November – March to June in the month visits of at least 2 -3 times. The abundance of different species was also recorded. In the present study majority of the insects were collected from Kodiveri dam region at two seasons I, II. In the present study, the data were analyzed for diversity index (H' $\log^2$) using the following Shannon – Wiener's formula (1949): Species richness (S) was calculated using two formulae given by Margalef and Simpson, 1958; Simpson index, 1949 (D); the evenness index equitability (J') was computed using the following formula of Pielou (1966). Multivariate methods of classification and ordination were used to compare communities on the basis of the identity of the component species as well as their relative importance in terms of abundance or biomass. Multivariate analysis can be accommodated under two collective terms, classification and ordination. Classification analysis seeks to assign entities to groups, whereas ordination attempts to place these spatially so that similar entities are close and dissimilar ones are distant. Commonly used classification method is cluster analysis. Ordination techniques include Principal Component Analysis (PCA), diversity profile and histogram. In the present study, the data were approached through cluster analysis ANOSIM, PAST and SIMPER. Bray – Curtis coefficient (Bray and Curtis, 1957) was used to produce the dendrogram.

Results

Diversity Indices

The month-wise occurrence of individuals during the month from August to November at season I am shown in (Table.1). The maximum individuals of 604 were observed in the month of October and the minimum individuals of 550 were recorded in the month of August. The month-wise occurrence of Shannon – Wiener diversity index (H') the maximum diversity index of 1.937 was observed in the month of September and the minimum diversity index of 1.908 was recorded in the month of October. The Margalef index (d) species richness the maximum species richness of 1.268 was observed in the month of August and the minimum species richness of 1.249 were recorded in the month of October. The month-wise occurrence of Simpson index (D) species richness the maximum species richness of 0.84 was observed in the month of August and the minimum species richness of 0.8304 were recorded in the month of October. The month-wise occurrence of Pielou's species evenness the maximum species evenness of 0.771 was observed in the month of September and the minimum species evenness of 0.7487 were recorded in the month of October.

Table.1. Diversity indices of insects from August to November at season I

Diversity	Aug	Sep	Oct	Nov
Taxa_S	9	9	9	9
Individuals	550	567	604	574
Dominance_D	0.16	0.1611	0.1696	0.1682
Simpson_1-D	0.84	0.8389	0.8304	0.8318
Shannon_H	1.932	1.937	1.908	1.909
Evenness_e^H/S	0.7671	0.771	0.7487	0.7497
Brillouin	1.894	1.9	1.873	1.872
Menhinick	0.3838	0.378	0.3662	0.3757
Margalef	1.268	1.262	1.249	1.259
Equitability_J	0.8793	0.8816	0.8683	0.8689
Fisher_alpha	1.528	1.519	1.5	1.515
Berger-Parker	0.2073	0.2169	0.255	0.2334
Chao-1	9	9	9	9

The month-wise occurrence of individuals during the month from March to June at season II is

shown in (Table.2). The maximum individuals of 383 were observed in the month of March and the minimum individuals of 359 were recorded in the month of June. The month-wise occurrence of Shannon – Wiener diversity index (H′) the maximum diversity index of 1.924 was observed in the month of June and the minimum diversity index of 1.871 was recorded in the month of May. The month-wise occurrence of Margalef index (d) species richness the maximum species richness of 1.36 was observed in the month of June and the minimum species richness of 1.345 were recorded in the month of March. The month-wise occurrence of Simpson index (D) species richness the maximum species richness of 0.836 was observed in the month of March and the minimum species richness of 0.826 were recorded in the month of May. The month-wise occurrence of Pielou's species evenness the maximum species evenness of 0.761 was observed in the month of September and the minimum species evenness of 0.722 were recorded in the month of May.

Table.2. Diversity indices of insects from March to June at season II

Diversity	Mar	Apr	May	Jun
Taxa_S	9	9	9	9
Individuals	383	371	361	359
Dominance_D	0.1636	0.1682	0.1735	0.1648
Simpson_1-D	0.8364	0.8318	0.8265	0.8352
Shannon_H	1.919	1.902	1.871	1.924
Evenness_e^H/S	0.7574	0.744	0.722	0.7608
Brillouin	1.87	1.85	1.82	1.87
Menhinick	0.4599	0.4673	0.4737	0.475
Margalef	1.345	1.352	1.358	1.36
Equitability_J	0.8735	0.8654	0.8517	0.8756
Fisher_alpha	1.651	1.663	1.673	1.675
Berger-Parker	0.2272	0.2399	0.241	0.2368
Chao-1	9	9	9	9

Diversity Profile

In the present investigation the diversity profiles drawn clearly demonstrated the diversity of insect's model in the four months from month August to November at season I (Fig.1). The curve for the October (604) months was lying at the top indicating higher diversity and curve for the November (574), September (567) and August (550) was lying at the bottom indicating lower diversity insect biodiversity at Season I.

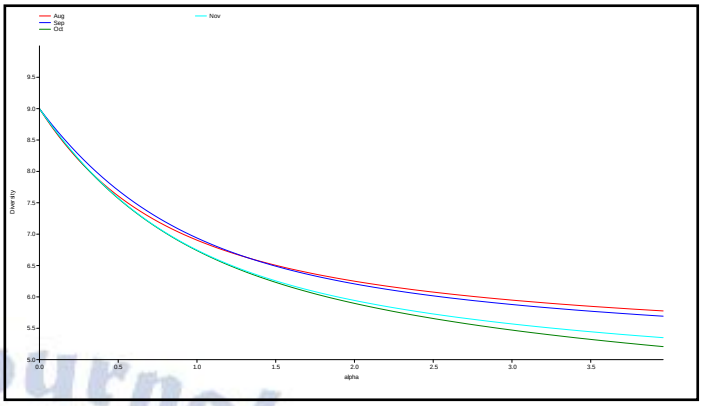

Fig.1: Month wise diversity profiles recorded from August to November at season I

In the present investigation the diversity profiles drawn clearly demonstrated the diversity of insect's model in the four months from month March to June at season II (Fig.2). The curve for the March (383) months was lying at the top indicating higher diversity and curve for the April (371), May (361) and June (359) was lying at the bottom indicating lower diversity insect biodiversity at Season II.

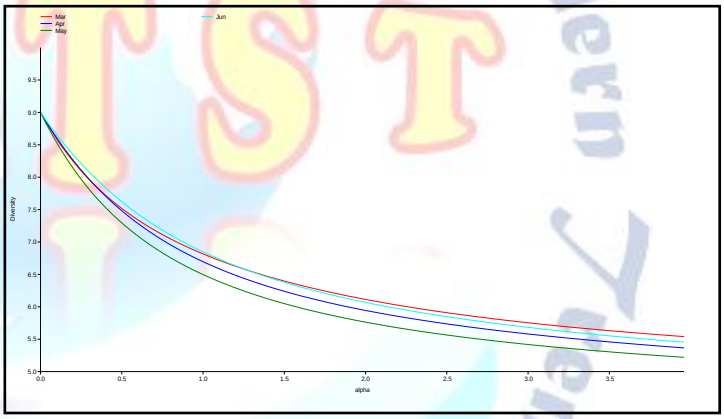

Fig.2: Month wise diversity profiles recorded from March to June at season II

Principal Component Analysis (PCA)

The PCA sampling process was done for four sampling months which is from August to November at season I. The PCA for the graph axes of the insects (orders) Odonata (515), Coleoptera (487), Diptera (344), Hemiptera (343), Orthoptera (313) and increased to be the highest and the least was recorded for Ephemeroptera (23) in season I (Fig.3).

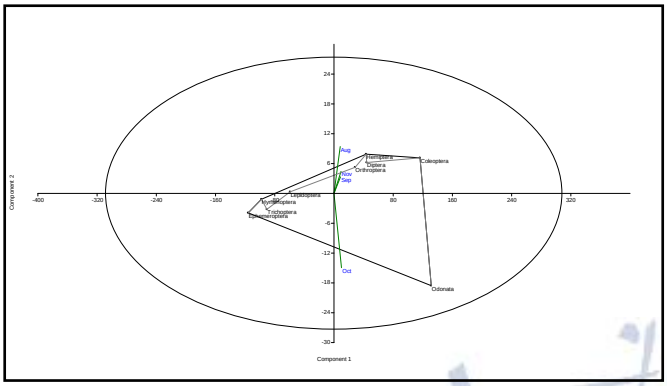

Fig.3: Month wise PCA profiles recorded from August to November at season I

The PCA sampling process was done for four sampling months which is from March to June at season II. The PCA for the graph axes of the insects (orders) Odonata (348), Coleoptera (298), Diptera (257), Hemiptera (224) and increased to be the highest and the least was recorded for Ephemeroptera (7) in season II (Fig.4).

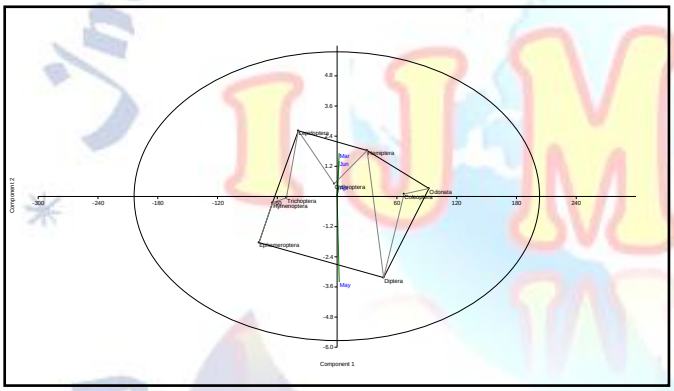

Fig.4: Month wise PCA profiles recorded from March to June at season II

Histogram

In the present investigation the histogram graph drawn clearly demonstrated the diversity of insect's model in the four months from month August to November at season I (Fig.5). The curve for the October months was lying at the top representing higher diversity and curve for the November, September and August was lying at the bottom indicating lower diversity insect biodiversity at Season I.

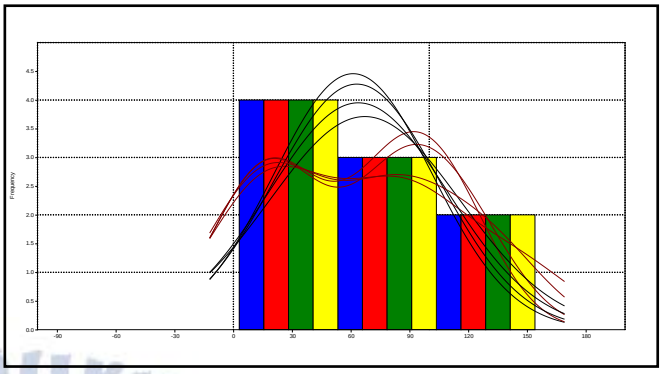

Fig.5: Month wise histogram recorded from August to November at season I

In the present investigation the histogram graph drawn clearly demonstrated the diversity of insect's model in the four months from month March to June at season II (Fig.6). The curve for the March months was lying at the top representing higher diversity and curve for the April, May and June was lying at the bottom indicating lower diversity insect biodiversity at Season II.

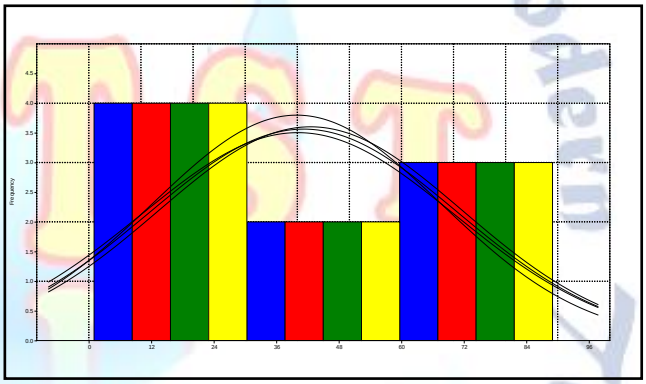

Fig.6: Month wise histogram recorded from March to June at season II

Clustering Analysis

In the present studies cluster analysis paired group link was done to study the grouping of the various in four months at season I from August to November (Fig.7). The dendrogram showed 1 and 2 groups. The major groups' high similarity insects were August & September, October and November.

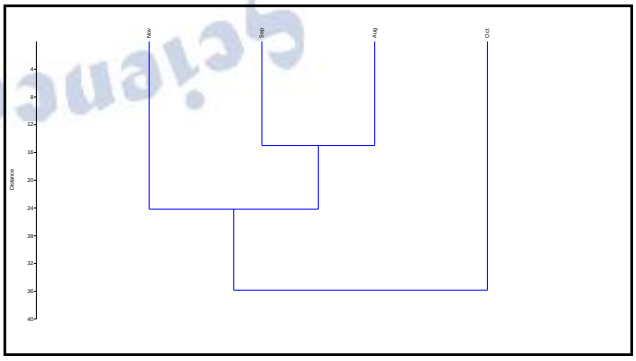

Fig.7: Month wise cluster analysis recorded from August to November at season I

In the present studies cluster analysis paired group link was done to study the grouping of the various in four months at season II from March to June (Fig.8). The dendrogram showed 1 and 2 groups. The major groups' high similarity insects were April & May, June and March.

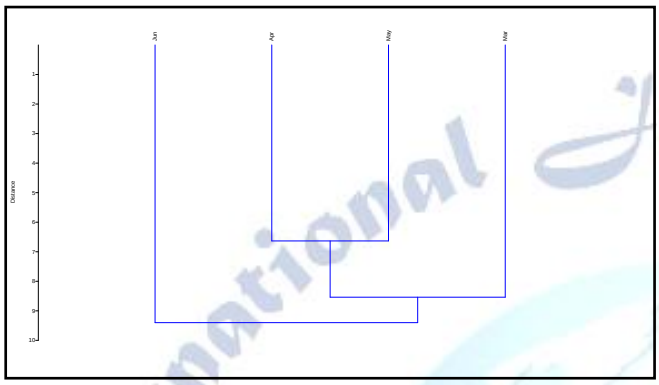

Fig.8: Month wise cluster analysis recorded from March to June at season II

Discussion

The month-wise occurrence of individuals during the month from August to November and March to June at season I, II is shown. The maximum individuals of 604 were observed in the month of October and the minimum individuals of 550 were recorded in the month of August at st I. The maximum individuals of 383 were observed in the month of March and the minimum individuals of 359 were recorded in the month of June at st II. The month-wise occurrence of Shannon – Wiener diversity index (H') the maximum diversity index of 1.937 was observed in the month of September and the minimum diversity index of 1.908 was recorded in the month of October at st I. The month-wise occurrence of Shannon – Wiener diversity index (H') the maximum diversity index of 1.924 was observed in the month of June and the minimum diversity index of 1.871 was recorded in the month of May at st II. The month-wise occurrence of Margalef index (d) species richness the maximum species richness of 1.268 was observed in the month of August and the minimum species richness of 1.249 were recorded in the month of October at st I. The month-wise occurrence of Margalef index (d) species richness the maximum species richness of 1.36 was observed in the month of June and the minimum species richness of 1.345 were recorded in the month of March at st II. The month-wise occurrence of Simpson index (D) species richness the maximum species richness of 0.84 was observed in the month of August and the minimum species richness of 0.8304 were recorded in the month of October at st I. The month-wise occurrence of Simpson index (D) species richness the maximum species richness of 0.836 was observed in the month of March and the minimum species richness of 0.826 were recorded in the month of May at st II. The month-wise occurrence of Pielou's species evenness the maximum species evenness of 0.771 was observed in the month of September and the minimum species evenness of 0.7487 were recorded in the month of October at st I. The month-wise occurrence of Pielou's species evenness the maximum species evenness of 0.761 was observed in the month of September and the minimum species evenness of 0.722 were recorded in the month of May at st II. A total of 7243 individuals of entamofauna representing 43 genera categorized under 332 families and 9 orders were collected from the upstream and downstream of the Sothuparai Reservoir; the aquatic entamofauna of upper stream constituted 43 genera, 32 families and 9 orders, while in downstream it was recorded as 35 genera, 27 families and 9 orders were recorded by Medona Mary R *et al.*, (2015). The monthly abundance of insects from (OCT- DEC) and during the survey October month insect abundance were rich in number (n=65) followed by November (n=62) and less in December (n=59) studied by Lekeshmanaswamy *et al.*, (2019). Nusrat Samweel and Tahir Nazir (2014) studied that the diversity indices (Shannon-Wiener) of aquatic insects ranged from 3.1282 - 4.4561 at S1 and 3.0270 - 4.3960 at S2 and maximum values of the diversity indices, 4.4561 and 4.3960 was recorded in February (winter) respectively at S1 and S2 and minimum values, 3.1282 and 3.0270 at S1 and S2 during July (monsoon), respectively. The Simpson Diversity Indices (0.79) revealed rich diversity and abundance in the region and arthropods and insects in particular, are the most species rich group of organisms on the planet were reported by Aland *et al* (2012). The diversity index represented by the Shannon-Weiner index ranged from 0.07 to 0.23, and the overall index was 1.26, and diversity evenness ranged between 0.26 and 0.42 observed by Meeran *et al.*, (2021). In the present study also indicates that the quality of aquatic environment is partially dependent on the abundance of aquatic insect population. The abundance, species richness and diversity increased with increasing plant diversity and landscape complexity. Diversity indices depend not only on species richness but also on

the evenness, or equitability, with which individuals are distributed among the different insect's species. High numbers of insect's taxa can be collected by comparably little effort allowing selective macro-habitat choice and relation to environmental variables. In the present study documents the composition of aquatic insect communities in different seasons studied. The number of recorded species in the present study signifies the rich diversity of aquatic insects in the only Kodiveri dam site of Erode district.

In the present results the abundance and distribution of aquatic insects species varies from one to another month during the study period. Their distribution was constant from one sampling date (monthly) to another. This indicates the richness and diverse group of aquatic insects in the study region. The PCA for the graph axes of the insects (orders) Odonata (515), Coleoptera (487), Diptera (344), Hemiptera (343), Orthoptera (313) and increased to be the highest and the least was recorded for Ephemeroptera (23) in season I. PCA ordination for data of aquatic insects can be separated into different months. The first group was located in positively axis Odonata and Coleoptera. PCA analysis revealed a correlation between the aquatic insect family and various months. The diversity profile analysis confirmed that the distribution, abundance and diversity of the aquatic insects are the highest insect density in the monsoon and summer seasons. The histogram curve for the October months was lying at the top representing higher diversity at Season I. The curve for the March months was lying at the top representing higher diversity at Season II. In the present studies cluster analysis paired group link was done to study the grouping of the various in four months at season I from August to November, season II from March to June. Based on this index, the statistics of aquatic insect and various moths, it can describe the quality of the fresh water is very good. The present research knowledge highlights the need of conservation of insect's faunal biodiversity to preserve the natural balance of the ecosystem.

Acknowledgement

Authors are thankful to Prof. Dr. Prabu, Assistant Professor, Department of Zoology, Chikkaiah Naicker College, Erode for the facilities and encouragement during the study period.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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